A systematic review of the antecedents of knowledge transfer: an actant-object view

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An Analysis of the Antecedents of Knowledge Transfer: An Actant-Object View

Purpose: While numerous studies have studied Knowledge Transfer (KT) and endeavored to address factors influencing KT, little effort has been made to integrate the findings of prior studies. We aim to classify the literature on KT through a detailed exploration of different perspectives of KT inter and intra organizations.

Design/methodology/approach: Using Actor Network Theory (ANT) as the baseline, we conducted a systematic review of KT research to summarize prior KT studies and classify the influential factors on KT. The review included 115 empirical articles published between 1987 and 2017.

Findings: Drawing on our review and ANT guidelines, we proposed a conceptual model to categorize KT antecedents into objects including those related to 1) knowledge, 2) knowledge exchange and 3) technology, as well as actants including those related to 4) organization, 5) team/business unit and 6) knowledge sender/receiver.

Research limitations/implications: Adopting a holistic synthesized approach based on ANT, this research puts forward a valid theoretical foundation on further understanding of KT and its antecedents. Indeed, this article investigates KT inter and intra organizations to recognize and locate the key antecedents of KT, which is of substantial applicability in today's knowledge-driven economy.

Practical implications: Our findings advance managers and practitioners' understanding of the important role of actants and objects and their interplay in KT practices.

Originality/value: While most studies have focused on one aspect of KT, this research contributes holistically to motivational, behavioral, technological and organizational aspects of KT. It also offers a thorough and context-free literature review on KT, which synthesizes the findings of prior studies on KT.

Keywords: Knowledge Transfer, Actor Network Theory (ANT), Objects, Actants, Antecedents, Knowledge Exchange, Systematic Review

Paper type: Literature review

Introduction

Rapid proliferation in the business potential of knowledge transfer (KT) attracts researchers from various fields to contribute to the growing body of research on this phenomenon. Although several scholars (e.g., Argote and Ingram, 2000, Kang *et al.*, 2010; Teo and Bhattacherjee, 2014) endeavored to highlight the benefits of KT in organizations, still many organizations cannot successfully yield the benefits of KT (Szulanski *et al.*, 2016), in part due to a lack of clear understanding of all aspects of KT and its complexities (i.e. the big picture). In addition, it is argued that KT literature is highly fragmented and there is no consensus on the conceptualization of KT and what determines its success in organizations (Argote and Ingram, 2000).

There have been some efforts to conduct literature reviews on KT. Examples are the review works accomplished by Frank et al. (2016) and Battistella et al. (2016). Our review shows that while the extant studies contribute to our understanding of KT, the majority have been conducted with a particular focus on one or few specific aspects of KT, and in a particular context (e.g., Muthusamy and White, 2005; Kamaşak and Bulutlar, 2010; Park *et al.,* 2015). Thus, they do not portray a complete picture of KT antecedents. Understanding this is key to accumulating theoretical knowledge and has important implications for organizations in various contexts. Despite the fact that the pertinent literature on KT is accumulating, the stream of research is still in the developmental stage, and arguably highly inconsistent (Park *et al.,* 2015).

In this paper, we seek to contribute to this area of research by providing a systematic review of KT research. We first explain the theoretical foundations of KT to be used as a baseline for our review. The review covers 115 articles published between 1987 and 2017. Building on our review, we develop a conceptual framework that summarizes the progress in KT research and provides future research directions. Rooted in Actor Network Theory (ANT), we focus on KT objects and actants in the proposed research framework. Unlike prior research that has a narrow scope and it is context dependent (e.g., Ahmad and Daghfous, 2010; Meier, 2011), our synthesized systemic analysis is context-free and can be applied within and among organizations within any sector, with any organizational size, and at any levels, i.e., individuals or teams.

With respect to the theoretical contribution, our proposed conceptual framework extends the work of recent scholars and offers a comprehensive review of key antecedents of KT, which informs our current knowledge and provides avenues for further research in this domain. Moreover, our research extends ANT to the context of KT and attempts to provide meaningful theoretical insights. This research also provides \ implications for managers who wish to successfully develop and implement KT practices in their organizations. In this regard, this research draws managers' attention to the paramount role of influential factors involved in a successful KT, which enable them to make their KT practices more value generating.

Theoretical Background

Knowledge Transfer

Several scholars (e.g., Argote and Ingram, 2000; Paulin and Suneson, 2012; Tangaraja *et al.*, 2016) attempted to define KT. While KT has been defined from various perspectives, a careful investigation into the conceptualization of KT highlights that it refers to the process of acquisition and utilization of new sets of knowledge-based resources. KT, as an important knowledge management activity in organizations, yields numerous benefits to organizations, e.g., cost efficiency (Goh, 2002), flexibility (Blome *et al.*, 2014) and competitive advantage (Kang *et al.*, 2010). Some scholars use the terms KT and Knowledge Sharing (KS) interchangeably, so they believe that these two concepts mean the same (Martín Cruz *et al.*, 2009). However, others (e.g., Paulin and Suneson, 2012) argue that KT and KS are not the same. Indeed, KT, as a whole, is a broader concept which encompasses KS practices (Tangaraja *et al.*, 2016). While the distinction between these two concepts is blurred, we apply KT and KS interchangeably in this research, not least because we intend to conduct a comprehensive literature review.

A review of existing literature on KT reveals that there are some scholars who attempted to conduct a systematic literature review and make connections between different works from various perspectives. For instance, Battistella et al. (2016) critically reviewed the relevant literature on inter-organizational technology/knowledge transfer. They proposed a model of technology/knowledge transfer and considered six categories related to the actors involved, i.e., sources, recipients and intermediaries, the relationship

between them, the object of the transfer, the channels and mechanisms and the reference context. In another study, Burmeister (2017) investigated Repatriate Knowledge Transfer (RKT) in the literature published between 2000 and 2015. As a result, she offered an integrated framework of the variables that affect RKT success. She proposed that the prerequisites for repatriation strategy implementation can be classified in three levels: individual, dyad and organization. In the context of software development, Ghobadi (2015) reviewed the literature on KT between 1993 and 2011 and suggested a classification framework which identifies four main drivers of KT: structure related drivers (team and organizational drivers), task related drivers, people related drivers and technology related drivers.

In the aforementioned studies (see also Li *et al.*, 2014), scholars chose various theoretical lens to delineate the literature review on KT. The most cited and applied theories in KT are reviewed in a study by Burmeister (2017) which are knowledge creation and organizational learning, resource (or knowledge) based view, social capital theory/social resources theory, communication theory, and social exchange theory. To the best of our knowledge, no systematic study on KT has been conducted by using ANT, which builds the theoretical grounding of this research. ANT enables us to better analyze the large body of literature on KT through the perspective of actants and objects involved in KT practices.

Actor-Network Theory (ANT)

Originally rooted in sociology of scientific knowledge, ANT explains the relation between underlying dissimilar elements of a heterogeneous network of aligned interests, including people, organizations and standards (Elder-Vass, 2015). It argues that all co-extensive networks comprise of both inseparable social and technical parts (Whittle and Spicer, 2008). Any actor, whether a person, an object (including technological tools or technical standards), or an organization, is equally important to a social network (Latour, 1996). The theory has been used by researchers to explore how networks are built, assembled and maintained to achieve a specific objective (Latour, 1996). It is necessary to note that ANT does not explain why a network exists; it focuses on the infrastructure of actor-networks, how they are formed and how they may fall apart (Latour, 2005). Since its introduction, ANT has undergone significant changes and evolutions

in different fields, and used in various contexts, from health care (e.g., Greenhalgh and Stones, 2010) to accounting (e.g., Justesen and Mouritsen, 2011) and management and organizations (e.g., Alcadipani and Hassard, 2010). Despite its popularity and potential contribution to understanding KT and its antecedents, to our knowledge there is no current study that used ANT in the knowledge-related contexts. Building on extant literature, we argue how this theory provides a robust foundation to our research framework and enables us to carefully investigate KT and its antecedents through an integrative analysis.

Drawing on ANT, we can identify, describe and justify the main elements of the network that facilitate KT. By relying on the conceptualization of ANT by Law (2008), we propose that in KT, actants (denote human and non-human actors) are included knowledge sender/receiver, team and organization, whereas objects refer to technology, knowledge and knowledge exchange (see Figure 1). We argue that actants should operate in the context of organizational norms, rules and strategies, team environment and expectations, available technology and the richness of knowledge base. Indeed, interactions in any KT practice are determined by a combination of different network constitutes. Network constitutes can be other actants and objects, such as knowledge base or technology. The interplay between actants and network elements lead to a systematic knowledge creation and knowledge exchange. Our conceptual framework demonstrated in Figure 1 highlights the interrelation of different actants and objects in the KT context.

-------Insert Figure 1 about here ------

Following Couldry's (2008) work on the application of ANT in exploring the role of media and communication technologies in contemporary societies, we apply ANT in the context of KT to explain the web of connections between actants and objects. We propose that knowledge senders/receivers, as the actant of KT activity, can learn from human agents, different business units, organizations, technologies and/or objects, and hence, they adjust their behavior in various ways in an intertwined network. We posit that the degree of KT, and the level/amount of content generated and disseminated by knowledge sender/receivers

are influenced by other factors within the infrastructure of KT actor-networks. These factors are carefully investigated in this research to delineate how they operate and interact in a network of KT.

Methodology

To conduct a synthesized comprehensive review, we followed the suggestions by Leidner and Kayworth (2006) on how to thoroughly (i) carry out a literature review, (ii) select and apply appropriate criteria for inclusion and exclusion of papers in the study, and finally (iii) develop a conceptual framework grounded in the literature. In order to review the literature, we proceeded with a search of databases in management and Information Systems (IS), e.g., AIS, Science Direct, EBSCO and ABI/Inform. To identify the relevant articles for our review, we utilized multiple terms and their combinations, such as knowledge transfer, knowledge sharing, and knowledge exchange. Furthermore, to ensure that our review is comprehensive, we reviewed bibliographies of the seminal papers and assessed the relevant work, known as backward research approach. Since the literature on this domain is very broad, we narrowed down our pool to empirical papers that directly focused on KT or KS. We thus excluded papers that discuss other theoretically overlapping but distinct concepts, such as knowledge interpretation from our review. Our search was also limited to articles published between 1987 and 2017. To determine the suitability of the papers for our study, we reviewed articles' abstract, introduction, and discussion/conclusion (Swanson and Ramiller, 1993).

As a result of adopting a multi-staged review approach discussed above, we finally identified 115 distinctive papers, which meet all the criteria listed above to be included in our review. Each selected paper was then further reviewed with respect to our research aim, adopted definitions, research constructs and conceptual framework. Having conducted this critical and comprehensive analysis, 91 uniquely independent variables were identified. Upon further classification and integration, six key themes emerged from our review that encompass all identified variables. The six key themes include knowledge exchange, knowledge sender/ receiver, organization, knowledge, team, and technology. Table 1 provides a summary of these six themes along with a statistical outline of each and their contributions to the whole review.

-------Insert Table 1 about here ------

By comparing the first and last columns of Table 1, we can identify the areas in the literature that are less developed. In the next section, each identified theme and its sub-variables are described.

Findings

Following ANT, we categorized KT antecedents into six. As demonstrated in Table 1, the first two themes, knowledge exchange and knowledge sender/receiver account for over half of elements involved in KT. Knowledge exchange refers to all significant aspects within the flow of knowledge. In fact, it is the actual process in which knowledge transfer happens. Therefore, it has been placed at the center of the model (Figure 1) to highlight that all other five antecedents of KT are linked together through knowledge exchange. Factors such as the levels of trust and risk involved, coordination requirements, speed and quality of knowledge being exchanged through a reciprocal flow between a sender and receiver are all investigated in this antecedent of KT. Table 2 depicts all 27 identified variables which encompass knowledge exchange based on prior research.

The second major antecedent of KT deals with the role of sender/ receiver within the process of KT (see also Minbaeva 2007). Effective KT highly depends on the ability and motivation of the knowledge sender to articulate knowledge and communicate with the receiver for an effective sharing (Massaro *et al.,* 2016; Miller *et al.*, 2016). Similar to knowledge sender, the capacity of knowledge receiver to absorb and utilize the transferred knowledge plays an important role in the success of KT (Vaghefi *et al.*, 2018). It should be noted that the variables involved in knowledge sender/receiver are different from the knowledge exchange. In knowledge exchange, our focus is on the process of exchange, whereas in knowledge sender/receiver antecedent, the specifications of knowledge sender/ receiver are investigated. A total of 20 variables are recognized in this category which include sender/receiver's motivation, experience, shared vision/goals,

credibility and tenure. A full list of variables along with a brief definition and a sample of studies referred to each are illustrated in Table 2.

------Insert Table 2 about here-------

The third most significant antecedent of KT relates to the organization, which highlights the importance of social and contextual factors influencing knowledge actants and objects and the interplay between them (Riege and Zulpo, 2007; Liebowitz *et al.*, 2007; Ardichvili, 2008). A total of 15 variables, including structure, distance, space, cost, etc. have been referred by prior studies as the key influential factors that define the organization of any KT activity.

Knowledge is the fourth recognized theme of KT which accounts over 10 percent of elements from the total elements. Indeed, the first essential enabler of any KT is related to the type and nature of knowledge being transferred. Extant research has revealed the significant role of knowledge attributes, such as explicitness (Bou-Llusar and Segarra-Ciprés, 2006), simplicity (Ambos and Ambos, 2009) and availability (e.g., Nakauchi *et al.*, 2017). See Table 2 for the full list of 11 variables of this antecedent. The last two KT themes highlight the importance of team and technology in any successful KT practice. In any KT, a team of at least two, i.e., sender and receiver must work together to exchange targeted knowledge. Issues, such as the extent of team members' openness to transfer new ideas/knowledge (e.g. Bellini *et al.*, 2016), autonomy to decide on various stages of KT (e.g., Ghobadi, 2015), and the degree of team being output oriented (Mueller, 2014) are discussed in this antecedent. Finally, technology refers to the mechanisms that are used in KT. Today, many organizations apply IT/IS as the main communication channel which provides them with a faster and more secured means of transferring knowledge. However, soft KT via IT/IS brings its own challenges, so issues such as the compatibility of IT systems of sender and receiver (e.g., Yu *et al.*, 2012), the level of technical support (e.g., Wehn and Montalvo, 2018) and training on the technology being used in KT (e.g., Bellini *et al.*, 2016) and the effectiveness/richness of the channel of exchange (e.g., Pee *et al.*, 2007) are essential factors to be considered in this antecedent of KT (see Table 2).

Having presented the six main antecedent categories of KT, it is imperative to note that not all identified categories are equally applicable and/or significant in all contexts of KT, both inter and intra organizations. This is not a surprising finding, as this paper intended to provide a comprehensive, yet a context-free review of factors affecting KT which covers both firm level and inter-firm KT considerations. To this end, our research aimed to provide a holistic basis for organizations to select and employ the KT antecedents that they find relevant to their KT practices, yet the findings should be interpreted with discretion.

Research Contributions

Our paper makes important contributions. From a theoretical perspective, adopting a holistic synthesized approach based on ANT puts forward a valid theoretical foundation on further understanding of KT and its antecedents. This theoretical lens helped us analyze the complex organizational behavior of KT from objects and actants' view. Accordingly, our research contributed to theoretically extending the application of ANT in KT. Moreover, our proposed framework contributes to KT research by providing an ontology of the underlying components of KT from a socio-technical point of view. Therefore, by adopting a comprehensive approach to recognize and locate the key antecedents of KT, we contribute to understanding the motivational, behavioral, technological and organizational aspects of KT. Taking all aforementioned aspects into account, this research contributes to existing literature by offering a comprehensive context-free literature review on KT, which synthesizes and generalizes the findings of prior studies on KT.

From a practical perspective, this study offers useful insights for both knowledge workers and business managers to help improve their KT processes and successfully manage them within and across their organizations. Our framework shows that a successful development and implementation of KT demands a high level of coordination and communication throughout the organizational structure, policies and culture. Hence, we draw managers' attention to the significance of adopting a holistic perspective in implementing KT and posits that managers need to carefully consider all key (correlated) antecedents of KT (as relevant to their work). Indeed, managers may not be able to realize the potential values of KT if they underestimate

key points, such as the characteristics of their organization, the type of technology used, and the nature and the attributes of knowledge being transferred. While providing no mandate, our framework can be used as a guideline for managers and organizations to understand the key factor that could affect the process of inter and intra organizational KT, and its eventual success.

Moreover, our research framework has the potential to be used as a basis for KT assessment tools. For example, through the lens of knowledge sender/receiver category, organizations can assess the strengths and weaknesses/shortcomings of a KT project team. Indeed, by using the six KT antecedents identified in this research organizations can outline how an assessment tool can be put together to identify the deficiencies in their existing KT system and thus find ways for improving it. For instance, an organization with different business units is required to apply effective communication models and methods within and between its businesses to increase efficiency, decrease wastes and finally enhance the organization's competitiveness. By applying our framework, managers can find potential communication barriers (noises) that may prevent an appropriate KT model, e.g., lack of trust, accuracy and credibility of the KT and its transferors (see Table 2). Also based on their current organization's circumstances, managers can detect which one of the KT antecedents works better in interactive vs. push or pull method of communication. The underlying assumption in here is that organizations are not static phenomenon and their environment and inter and intra interactions need to be dynamically maintained. This can be considered as one of the key empirical contributions of this study, as the existing literature provides little direction to managers on how to reap the most benefits from their investment on KT practices. In this regard, the present research endeavors to encourage managers to adopt a holistic perspective on where managerial efforts and resources should be invested to foster KT in their organizations.

Conclusion, Limitations and Future Studies

In this paper, we provided an overview of the current knowledge on KT, and proposed a conceptual framework based on ANT, which highlighted the critical factors for the management and organization of KT. Based on ANT, we categorized KT antecedents into actants and objects. The KT antecedents that are

related to actants are human-oriented, while the object antecedents were related to artifacts that facilitate KT. We found three categories of actants related to organization, team, and knowledge sender/receiver, and three categories of objects related to technology, knowledge exchange and knowledge. For each category, the main elements, including both positive and negative factors were investigated for the implementation of KT in organizations. Our findings advance extant research on the key elements that influence KT process: (1) individual choices on knowledge characteristics, (2) knowledge exchange environment, (3) knowledge senders and receivers' specifications, (4) organizational capacity, (5) team provisions and (6) KT technological enablers.

A few limitations need to be acknowledged. The first limitation of this research is related to the selected keywords for review. KT literature is increasingly growing and since the findings of this research are based on the reviewed studies in the current literature, universality and generalizability of the results might be questioned. Similarly, as our research is established on the findings of the reviewed papers, the limitation of these studies may restrict the findings of our research (Ghobadi, 2015). Future studies may update the findings of this research. Additionally, as our focus was on identifying the actants and objects of the KT (demonstrated in Figure 1), investigating the interactions between the KT antecedents and understanding the possible bidirectional relationships between these elements were beyond the scope of this research. Future research is needed to pay specific attention to such relationships and carefully assess the nature and direction of the link between the antecedents to further develop this research findings. Moreover, for each type of six identified categories, new theoretical perspectives can be employed to add further insights to the body of extant knowledge. Finally, as discussed in the findings section, some themes of KT, e.g., technology are still underdeveloped, and few scholars have highlighted the significant role of these antecedents in the KT process. Future research is needed in such domains to enrich the existing knowledge base, particularly looking at knowledge, team and technology themes to shed more light on these less-researched domains of KT.

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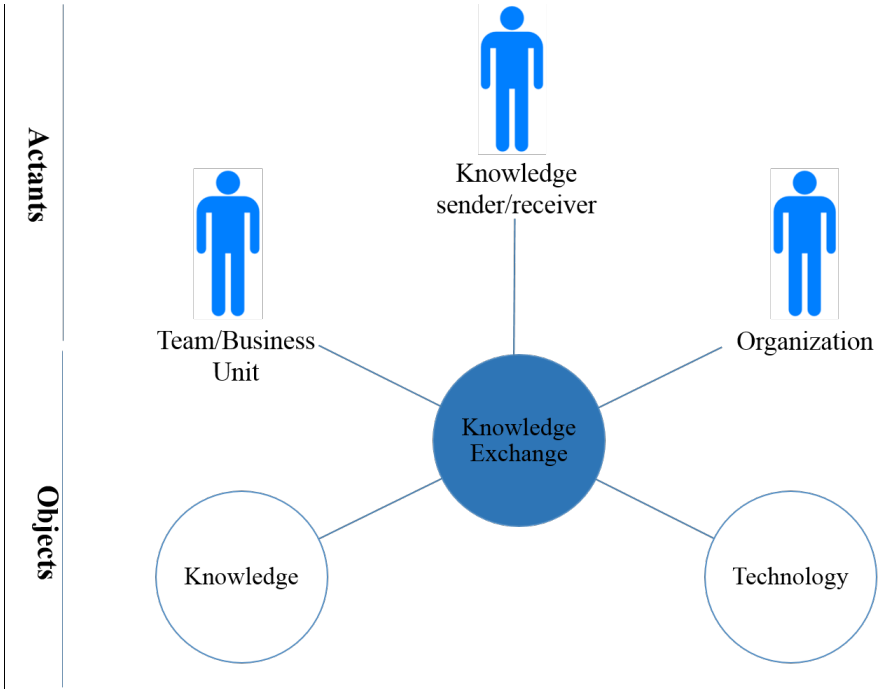

Figure 1: The proposed research framework

Table 1- Descriptive statistics

KT antecedents	Total no. of elements per each antecedent	Percentage of elements from total identified elements	Total no. of reviewed studies	No. of items per each category cited more than 3 times
Knowledge exchange	27	30%	65	10
Knowledge sender/ receiver	20	22%	75	9
Organization	15	16%	52	5
Knowledge	11	12%	45	6
Team	10	11%	13	2
Technology	8	9%	23	2
Total	91	100%	-	-

Table 2: The antecedents of KT

No.	Variables	Definition	Studies
Knowledge Exchange			
1	Trust	The extent of accuracy and credibility of KT and its knowledge transferors.	(Barson *et al*., 2000; Disterer, 2001; Sharratt and Usoro, 2003; Levin and Cross, 2004; Malhotra and Majchrzak, 2004; Bock *et al*., 2005; Inkpen and Tsang, 2005; Riege, 2005; Chiu *et al*., 2006; Hodgkinson, 2006; Watson and Hewett, 2006; Zárraga-Oberty and De Saá-Pérez 2006; Jabr, 2007; Riusala and Smale, 2007; Li *et al*., 2007; Park and Im, 2007; Pee *et al*., 2007; Riege, 2007; Ardichvili, 2008; Becerra *et al*., 2008; Bonache and Zárraga-Oberty, 2008; Easterby-Smith *et al*., 2008; Lin *et al*., 2008; Liao, 2008; Van Wijk *et al*., 2008; Duan *et al*., 2010; Chen *et al*., 2014a; Chen *et al*., 2014b; Li et al., 2014; Kang and Hau, 2014; Ghobadi, 2015; Battistella *et al*., 2016; Bellini *et al*., 2016; Miller *et al*., 2016; Burmeister, 2017; Nakauchi *et al*., 2017)
2	Tie strength	The extent of closeness and frequency of interactions within a relationship between two parties.	(Hansen, 1999; Reagans and McEvily, 2003; Levin and Cross, 2004; Riege, 2005; Li *et al*., 2007; Van Wijk *et al*., 2008; Kang and Hau, 2014; Ghobadi, 2015; Leonardi and Meyer, 2015; Battistella *et al*., 2016; Bellini *et al*., 2016; Burmeister, 2017; Nakauchi *et al*., 2017; Peltokorpi and Yamao, 2017)
3	Communication competence	The skills require to perform appropriate communicative behaviours, e.g., face-to-face communication in the process of KT.	(Albino *et al*., 2004; Riege, 2005; Ko *et al*., 2005a; Ko *et al*., 2005b; Yih-Tong Sun and Scott, 2005; Jabr, 2007; Joshi *et al*., 2007; Pee *et al*., 2007; Murray and Peyrefitte, 2007; Xu and Ma, 2008; Chen *et al*., 2014a; Ghobadi, 2015; Leonardi and Meyer, 2015; Miller *et al*., 2016)
4	Arduous relationship	An emotionally laborious and distant relationship between a source and a recipient of knowledge	(Szulanski, 1996; Ko *et al*., 2005a; Pee *et al*., 2007; Xu and Ma, 2008; Szulanski *et al*., 2016)
5	Time	KT requires time to find the right person, contact the person, retrieve the necessary knowledge, and integrate the new knowledge.	(Riege, 2005; Jabr, 2007; Riege, 2007; Mueller, 2014; Zhao *et al*., 2015)
6	Shared understanding	It refers to the similarities in grasp and the level of experience between a consultant and client.	(Ko *et al*., 2005a; Pee *et al*., 2007; Teo and Bhattacherjee, 2014; Bellini *et al*., 2016)
7	Risk- Ownership	KT inherently involves some levels of risk, particularly where proprietary knowledge is being shared. It refers to the fear of losing ownership of knowledge.	(Barson *et al*., 2000; Yih-Tong Sun and Scott, 2005; Riege, 2007; Becerra *et al*.; 2008)
8	Reciprocity	The level of desire in maintaining ongoing relationships with others.	(Barson *et al*., 2000; Bock *et al*., 2005; Chiu *et al*., 2006; Kang, 2016)
9	Social capital	It refers to (i) structural capital, also known as cognitive capital (e.g., shared values, language and codes) and (ii) relational capital (e.g., trusting inter-organizational relationship).	(Van den Hooff and Huysman, 2009; Yu *et al*., 2012; Kang and Hau, 2014; Massaro *et al*., 2016)
10	Coordination	The extent to which activities, people, routines, and assignments work together to accomplish objectives and promote mutual understanding.	(Chen *et al*., 2014a; Loebbecke *et al*., 2016; Miller *et al*., 2016)
11	Communication flows	Open and effective communication (openness).	(Bresnen *et al*., 2003; Riege, 2005; Riege, 2007; Bellini *et al*., 2016)
12	Communities of Practice (CoP)	An effective approach to foster KT is to think together, to stay in touch with each other and to share ideas with each other.	(Disterer, 2001; Ghobadi, 2015; Massaro *et al*., 2016)
13	Anticipated emotions and attitudes	It refers to forward-looking affective reactions, when the person imagines the emotional consequences of sharing or not sharing.	(Ghobadi, 2015; Nylund and Raelin, 2015)
14	Speed and quality	The degree of speed and the level of quality in the knowledge being transferred through an effective communication.	(Jabr, 2007; Al-Salti, 2009)
15	KT target	To identify the area/context/unit in which knowledge is employed.	(Barson *et al*., 2000)
16	Intrusive	Knowledge should be transferred through efficient mechanisms which minimise the work requirements.	(Riege, 2007)
17	Overload (Lean KT)	How KT practices are designed to reduce information overload.	(Riege, 2007)

18	Managers 'Mistake Tolerance Levels	It captures and evaluates past honest mistakes without being too critical of them.	(Riege, 2007)
19	Conflict avoidance	It implies the attitudes of conflict avoidance and conservative habits which may prevent the transfer of knowledge.	(Disterer, 2001)
20	Knowledge governance	It includes all efforts to support cross-project KT to pursue the best result.	(Zhao *et al*., 2015)
21	Ease of KT	It implies why individuals transfer knowledge to some individuals but not to others.	(Reagans and McEvily, 2003)
22	Collective training	It refers to a process whereby sources of knowledge are imparted by involving knowledge recipients in interactions with those who use it.	(Nakauchi *et al*., 2017)
23	Career advancement	The degree to which a member believes KT will affect their career.	(Sharratt and Usoro, 2003)
24	Accuracy	How accurately the recipient reproduces a practice of the organizational template.	(Szulanski *et al*., 2004)
25	Density	The extent to which knowledge sender and receiver know each other.	(Nakauchi *et al*., 2017)
26	Diversity	The number of knowledge elements that is connected to the knowledge sender and receiver.	(Brennecke and Rank, 2017)
27	Partner protectiveness	It involves specialized personnel in KT, e.g., technological gatekeepers and specialized groups within organizational structures, e.g., KT groups or the pricing of access to proprietary information.	(Simonin, 1999)
Knowledge Sender and Receiver			
1	Motivation (Source - Recipient)	The degree of willingness and belief in the value of knowledge being shared.	(Szulanski, 1996; Barson *et al*., 2000; Disterer, 2001; Govindarajan and Gupta, 2001; Malhotra and Majchrzak, 2004; Bock *et al*., 2005; Burgess, 2005; Ko *et al*., 2005a; Voelpel and Han, 2005; Dyer and Hatch, 2006; Watson and Hewett, 2006; Riege and Zulpo, 2007; Milne, 2007; Minbaeva, 2007; Ardichvili, 2008; Easterby-Smith *et al*., 2008; Lin *et al*., 2008; Xu and Ma, 2008; Pérez-Nordtvedt *et al*., 2008; Al-Salti, 2009; Oddou *et al*., 2009; Duan *et al*., 2010; Song, 2014; Teo and Bhattacherjee, 2014; Ghobadi, 2015; Bellini *et al*., 2016; Massaro *et al*., 2016; Miller *et al*., 2016; Szulanski *et al*., 2016; Burmeister, 2017; Wei and Miraglia, 2017)
2	Absorptive capacity (Retentive capacity)	It implies the ability to assess, assimilate, institutionalize and apply acquired knowledge.	(Szulanski, 1996; Szulanski *et al*., 2004; Ko *et al*., 2005a; Dyer and Hatch, 2006; Inkpen and Pien, 2006; Pee *et al*., 2007; Riusala and Smale, 2007; Easterby-Smith *et al*., 2008; Van Wijk *et al*., 2008; Xu and Ma, 2008; Al-Salti, 2009; Oddou *et al*., 2009; Yeoh, 2009; Duan *et al*., 2010; Meier 2011; Yu *et al*., 2012; Minbaeva *et al*., 2014; Song, 2014; Iyengar *et al*., 2015; Zhao *et al*., 2015; Khan *et al*., 2015; Massaro *et al*., 2016; Miller *et al*., 2016; Szulanski *et al*., 2016; Burmeister, 2017; Liao *et al*., 2017)
3	Disseminative capacity	It refers to team members' knowledge, skills, experience and background which collectively contribute to teams' capability in KT.	(Grant, 1997; Simonin, 1999; Barson *et al*., 2000; Govindarajan and Gupta, 2001; Bresnen *et al*., 2003; Haghirian, 2003; Malhotra and Majchrzak, 2004; Watson and Hewett, 2006; Joshi *et al*., 2007; Park and Im, 2007; Riege, 2007; Ardichvili, 2008; Easterby-Smith *et al*., 2008; Lin *et al*., 2008; Al-Salti, 2009; Yeoh, 2009; Oddou *et al*., 2009; Song, 2014; Ghobadi, 2015; Zhao *et al*., 2015; Battistella *et al*., 2016; Massaro *et al*., 2016; Burmeister, 2017; Nakauchi *et al*., 2017)
4	Experience	The greater the level of prior experience/expertise of the knowledge seeker with the underlying knowledge domain, the less ambiguous the knowledge to be transferred.	(Simonin, 1999; Riege, 2005; Pee *et al*., 2007; Riege, 2007; Santhanam *et al*., 2007; Ringberg and Reihlen, 2008; Oddou *et al*., 2009; Kamaşak and Bulutlar, 2010; Duan *et al*., 2010; Kang and Hau, 2014; Argote and Fahrenkopf, 2016; Nakauchi *et al*., 2017)
5	Shared vision/goals	It concerns a bonding mechanism that helps different parts of an organization to integrate resources to reach the organization's goals.	(Inkpen and Tsang, 2005; Riege, 2005; Chiu *et al*., 2006; Li *et al*., 2007; Van Wijk *et al*., 2008; Ghobadi, 2015; Bellini *et al*., 2016; Peltokorpi and Yamao, 2017; Liao *et al*., 2017)
6	Power and status seeking authorities	The degree that a person/party/agent can change or control the behaviour of other persons/parties/agents within KT process.	(Disterer, 2001; Jabr, 2007; Riege, 2007; Riusala and Smale, 2007; Liao, 2008; Easterby-Smith *et al*., 2008; Oddou *et al*., 2009)

7	Credibility	It refers to the reliability and reputation of a knowledge sender.	(Szulanski, 1996; Dyer and Hatch, 2006; Elwyn *et al*., 2007; Joshi *et al*., 2007; Pee *et al*., 2007; Al-Salti, 2009; Li *et al.,* 2014; Ghobadi, 2015)
8	Tenure	It concerns (i) the respondent's length of employment, (ii) the length of the time that team members have work together, and (iii) the age of the respondent.	(Riege, 2005; Riege, 2007; Liebowitz *et al*., 2007; Kang and Hau, 2014; Ghobadi, 2015; Nakauchi *et al*., 2017)
9	Personality differences (gender, race, rank)	The differences in individual characters in terms of their tastes, preferences, gender, race education level, and rank which might affect their direct confrontation and communication with relevant parties.	(Reagans and McEvily, 2003; Riege, 2005; Yih-Tong Sun and Scott, 2005; Riege, 2007; Nakauchi *et al*., 2017)
10	Uncertainty	Knowledge sender or receiver are not certain about the value of the knowledge to be transferred.	(Disterer, 2001; Battistella *et al*., 2016)
11	Identification	It refers to one's conception of self in terms of the defining features of self-inclusive social category.	(Chiu *et al*., 2006; Ghobadi, 2015)
12	Proximity	Similarity in senders' embeddedness in the knowledge network.	(Slaughter and Kirsch, 2006; Brennecke and Rank, 2017)
13	Job security	It implies apprehension or fear towards sharing knowledge because it may jeopardise one's job security.	(Riege, 2005; Riege, 2007)
14	Sense of self-worth	It captures the extent to which employees see themselves as providing value to their organizations through their KT activities.	(Bock *et al*., 2005)
15	Perceived punishment	Employees are less likely to exchange information in the absence of openness, psychological safety.	(Burgess, 2005)
16	Incoherent paradigms	It considers the difficulties in articulating and justifying personal beliefs which do not fit with the ruling paradigms of the organization.	(Disterer, 2001)
17	Self-efficacy	The degree of influence on downward KT.	(Kang, 2016)
18	Recipient's starting conditions	It refers to knowledge receiver's mind-set and level of knowledge.	(Ghobadi, 2015)
19	Need to become part of the group	It refers to the desire of individuals to feel part of the team and share knowledge with other team members.	(Ghobadi, 2015)
20	Distributive justice	It is defined as the perceived fairness of organizational rewards that an employee may receive after sharing knowledge with others.	(Ghobadi, 2015)
Organization			
1	Culture	The existence of collective characteristics, behaviour's, norms and values that influence the interactions between individuals and their intention towards KT behaviour.	(Simonin, 1999; Barson *et al*., 2000; Disterer, 2001; Gold *et al*., 2001; McDermott and O'Dell, 2001; Bresnen *et al*., 2003; Haghirian, 2003; Albino *et al*., 2004; Bock *et al*., 2005; Burgess, 2005; Inkpen and Tsang, 2005; Riege, 2005;Voelpel and Han, 2005; Liebowitz *et al*., 2007; Riege, 2007; Riege and Zulpo, 2007; Ajmal and Koskinen, 2008; Ardichvili, 2008; Ringberg and Reihlen, 2008; Ambos and Ambos, 2009; Salti, 2009; Van den Hooff and Huysman, 2009; Duan *et al*., 2010; Tuan, 2012; Li *et al*., 2014; Mueller, 2014; Al- Battistella *et al*., 2016; Benbya, 2016; Kang, 2016; Massaro *et al*., 2016; Burmeister, 2017; Wei and Miraglia, 2017)
2	Structure	The degree of bureaucracy, hierarchy and flexibility determines the level of formality and control over KT practices.	(Grant, 1997; Gold *et al*., 2001; Bresnen *et al*., 2003; Sharratt and Usoro, 2003; Riege, 2005; Ivory et al., 2007; Riege, 2007; Riusala and Smale, 2007; Easterby-Smith *et al*., 2008; Van Wijk *et al.,* 2008; Van den Hooff and Huysman, 2009; Zaidman and Brock, 2009; Duan *et al*., 2010; Ghobadi, 2015; Benbya, 2016)
3	Distance	It refers to geographic (space-distance), linguistic and normative distance in KT behaviour.	(DeCarolis and Deeds, 1999; Simonin, 1999; Barson *et al*., 2000; Van Wijk *et al.,* 2008; Al-Salti, 2009; Ambos and Ambos, 2009; Jones and Low, 2006; Duan *et al*., 2010; Ghobadi, 2015; Ahammad *et al.,* 2016; Battistella *et al.,* 2016; Bellini *et al*., 2016)
4	Reward and recognition system	An effective incentive system ensures that everyone contributes to what and to whom it matters.	(Burgess, 2005; Riege, 2005; Riege, 2007; Bellini *et al.,* 2016; Benbya, 2016)

5	Resources	It refers to all types of resources and infrastructure to successfully support transfer practices and opportunities.	(Barson *et al.,* 2000; Riege, 2005; Riege, 2007; Massaro *et al.,* 2016)
6	Template-Methodology	It implies all routines and methods for identifying, acquiring, structuring, generating, storing, distributing and assessing knowledge.	(Barson *et al.*, 2000; Jensen and Szulanski, 2007; Wei and Miraglia, 2017)
7	Context	The degree to which an organizational context supports the development of KT.	(Szulanski *et al.*, 2004; Van Wijk *et al.,* 2008; Battistella *et al.,* 2016)
8	Direction and strategy	It highlights the essential need for senior management support of KT activities.	(Barson *et al.,* 2000; Riege, 2005; Riege, 2007)
9	Organizational size	It facilitates ease of sharing.	(Riege, 2005; Riege, 2007; Van Wijk *et al.,* 2008)
10	Transactive memory	It refers to the knowledge of who knows what.	(Yu *et al.,* 2012; Ghobadi, 2015)
11	Space	A physical work environment and layout of work areas may restrict/promote KT.	(Riege, 2005; 2007)
12	Competitiveness	The degree of external or internal competitiveness within and across business units which may encourage/discourage them towards KT.	(Riege, 2005; 2007)
13	Procedural	It concerns what knowledge sources can/cannot be shared due to security and confidentiality considerations.	(Ardichvili *et al.,* 2003; Garfield, 2006)
14	Cost	It refers to the cost of managing KT collaboration.	(Barson *et al.* 2000)
15	Ethics	The subjective portion of the starting points of any human behaviour process encompassing business.	(Tuan, 2012)
Knowledge			
1	Tacitness (Codifiability)	It refers to the degree that knowledge can be broken down into specific components which are unambiguous and easy to understand.	(Simonin, 1999; Reagans and McEvily, 2003; Bou-Llusar and Segarra-Ciprés, 2006; Inkpen and Pien, 2006; Zhang, 2006; Riusala and Smale, 2007; Becerra *et al.,* 2008; Pérez-Nordtvedt *et al.*, 2008; Xu and Ma, 2008; Yeoh, 2009; Kang *et al.*, 2010; Teo and Bhattacherjee, 2014; Park *et al.,* 2015; Battistella *et al.,* 2016; Loebbecke *et al.*, 2016; Burmeister, 2017; Kudaravalli *et al*., 2017; Nakauchi *et al.*, 2017)
2	Availability	The extent to what knowledge is available and easily accessible for use.	(Malhotra and Majchrzak, 2004; Watson and Hewett, 2006; Ivory *et al.*, 2007; Ajmal and Koskinen, 2008; Bonache and Zárraga-Oberty, 2008; Xu and Ma, 2008; Lin *et al.,* 2008; Benbya, 2016; Nakauchi *et al.,* 2017)
3	Casual ambiguity	The degree of understanding between determinants and consequences of actions.	(Szulanski, 1996; Szulanski *et al.,* 2004; Dyer and Hatch, 2006; Riege and Zulpo, 2007; Bonache and Zárraga-Oberty, 2008; Easterby-Smith *et al.*, 2008; Van Wijk *et al.*, 2008; Xu and Ma, 2008; Duan *et al.,* 2010; Szulanski *et al.,* 2016)
4	Complexity-Difficulty	The extent to what KT is demanding and complicated and it consists of several interacting elements, such as related practices, individuals, skills, resources.	(Simonin, 1999; Bou-Llusar and Segarra-Ciprés, 2006; Riusala and Smale, 2007; Easterby-Smith *et al.,* 2008; Xu and Ma, 2008; Kang *et al.,* 2010; Leonardi and Meyer, 2015; Battistella *et al.,* 2016)
5	Value of knowledge importance	The degree of value perceived in KT which promotes higher engagement in the process of KT.	(Sharratt and Usoro, 2003; Malhotra and Majchrzak, 2004; Riege, 2005; Watson and Hewett, 2006; Riege, 2007; Pérez-Nordtvedt *et al.*, 2008; Kang *et al.*, 2010; Battistella *et al.*, 2016)
6	Language	The difficulty and influence of language on the process of knowledge transfers, particularly when it meant to occur in a foreign language.	(Disterer, 2001; Haghirian, 2003; Riege, 2005; Voelpel and Han, 2005; Chiu *et al.,* 2006; Riege, 2007; Duan *et al.*, 2010; Peltokorpi and Yamao, 2017)
7	Specificity-Contextuality-Criticality	The more knowledge is context-specific, the more difficult it can be used in different contexts.	(Bou-Llusar and Segarra-Ciprés, 2006; Battistella *et al.*, 2016; Burmeister, 2017)
8	Proneness	The degree of conjecture on the utility of the transferred knowledge.	(Szulanski *et al*., 2004)
9	Systemic	Autonomous nature of knowledge	(Bou-Llusar and Segarra-Ciprés, 2006)

10	Volatility	The temporary value of the knowledge	(Zhang, 2006)
11	Comprehensiveness	The extent to which knowledge is unambiguous, diverse and complete.	(Benbya, 2016)
Team			
1	Responsibility-Leadership	Knowledge needs to be "nurtured, supported, enhanced, and cared for" within teams.	(Disterer, 2001; Riege, 2005; Voelpel and Han, 2005; Oddou *et al*., 2009; Mueller, 2014; Ghobadi, 2015; Bellini *et al*., 2016; Massaro *et al*., 2016; Burmeister, 2017)
2	Openness to ideas	Being keen to deviate from a common trend of thought.	(Yih-Tong Sun and Scott, 2005; Duan *et al*., 2010; Bellini *et al*., 2016; Liao *et al*., 2017)
3	Climate	The relational and trusting relationship would implicitly effect KT.	(Yih-Tong Sun and Scott, 2005; Zhao *et al*., 2015)
4	Confidence	Team confidence in the individual/acceptance of the individual.	(Yih-Tong Sun and Scott, 2005)
5	Heterogeneity	It refers to the degree of dispersion among team members in terms of their demographic characteristics, experiences, skills, cognitions, and values.	(Ghobadi, 2015)
6	Autonomy	The extent to which a team in the organization has been given the freedom, independence, and discretion to determine what actions are required and how best to execute them.	(Ghobadi, 2015)
7	Team building activities	Communication, problem solving, decision making, adaptability, planning, and trust building activities.	(Bellini *et al*., 2016)
8	Output orientation	It focuses on the intended final product or results of teamwork.	(Mueller, 2014)
9	Interdependencies	It refers to the degree to which team members depend on each other for completing their tasks.	(Ghobadi, 2015)
10	Perceived indispensability	It reflects the perceived importance of one's own contributions for the team outcome.	(Ghobadi, 2015)
Technology			
1	IT systems and tools	It considers communication channels used in the provision and exchange of Knowledge.	(Alavi and Leidner, 2001; Barson *et al*., 2000; Bollinger and Smith, 2001; Gold *et al*., 2001; Bresnen *et al*., 2003; Malhotra and Majchrzak, 2004; Murray and Peyrefitte, 2007; Riege, 2007; Ardichvili, 2008; Al-Salti, 2009; Van den Hooff and Huysman, 2009; Duan *et al*., 2010; Yu *et al*., 2012; Ghobadi, 2015; Bellini *et al*., 2016)
2	Technical support	It refers to the internal and/or external supports and immediate maintenance of integrated technology in KT.	(Riege, 2005; Riege, 2007; Santhanam *et al*., 2007; Ardichvili, 2008)
3	Compatibility	It concerns the ability to share any type of knowledge sources across various technology components/ infrastructures.	(Riege, 2005; Riege, 2007; Yu *et al*., 2012)
4	Reluctance to use integrated IT systems	The lack of familiarity and experience with systems and tools.	(Riege, 2005; Voelpel and Han, 2005; Riege, 2007)
5	Perceived usefulness/ Ease of use	The degree of perceived value in the applicability and usefulness of a technology/system in the process of KT.	(Sharratt and Usoro, 2003; Nakauchi *et al*., 2017)
6	Channel richness (effectiveness)	The degree of effectiveness of knowledge being exchanged between a vendor and a client by using an electronic communication channel.	(Xu and Yao, 2006; Pee *et al*., 2007)
7	Training	The level of training provided by an organization to familiarise their staff with the new IT/non-IT systems used for KT.	(Riege, 2005; Bellini *et al*., 2016)
8	Expectations	It refers to the level of expectations as to what technology can do or cannot do with respect to KT activities.	(Riege, 2005; 2007)